An Upper Michigan Population Of *Cicindela Repanda* With Reduced Elytral Maculae (Coleoptera: Cicindelidae)

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On August 23, 1959 Anne Graves and I collected a series of 69 specimens of *Cicindela repanda* Dejean along the shore of Lake Superior at Grand Sable Sand Dunes, Alger County, Michigan. This population is interesting because of the large percentage of individuals with broken and greatly reduced elytral maculae.

The Grand Sable Dunes are one of the world's most impressive examples of shoreline sand dunes, rising abruptly some 700 feet from the narrow beach. The dunes are located from 3-7 miles west of the village of Grand Marais. The exact locality from which the 69 specimens were taken is known locally as the "Log Slide" about 6 miles due west of Grand Marais from which it was reached via primitive road. After parking the car at the "Log Slide" one slides down the face of the dune to the beach. We encountered difficulty in climbing back up an almost vertical wall of loose dry sand, which forms an effective barrier to the population of *C. repanda* below. This population occupies a narrow strip of moist sand beach only a few yards wide and is therefore partially isolated. There are several ravines cut into the face of the dune which provide shelter from high waves of Lake Superior. Small streams flow through these deep ravines, keeping the sand constantly moist; it is in these protected ravines that the larvae of *C. repanda* (and *C. hirticollis)* develop.

The population of *C. repanda* from Grand Sable Dunes was mentioned in Graves (1963) but has not been described previously. Of the 69 specimens, 51 (73.9%) have the elytral maculae not only narrowed but actually divided or "broken" including 15 (21.7%) in which the normal elytral pattern exists only as isolated spots (Fig.1).

In another member of the "*repanda* group", *C. duodecimguttata,* reduction of the elytral maculae into dots is normal, but in *C. repanda* it is rare. Vaurie (1951) described *C. repanda novascotiae* from Nova Scotia, Prince Edward Island, and the Magdalen Islands; in this population a high percentage of individuals have narrowed, broken or obliterated elytral maculae, only 24% resembling *C. repanda repanda* in their complete markings. In Newfoundland the population is rather typical and cannot be referred to *novascotiae* (Lindroth, 1955).

In the northern Great Lakes area, surrounding populations of *C. repanda* show varying degrees of macular reduction. Specimens from Sibley Provincial

Park, Ont. (9), Black River Park, Gogebic Co., Mich. (24), Waugoshance Point, Emmet Co., Mich. (28), and others contain occasional individuals with maculae narrowed and even broken but not reduced to dots. Those from Superior, Wis. are strongly maculated.

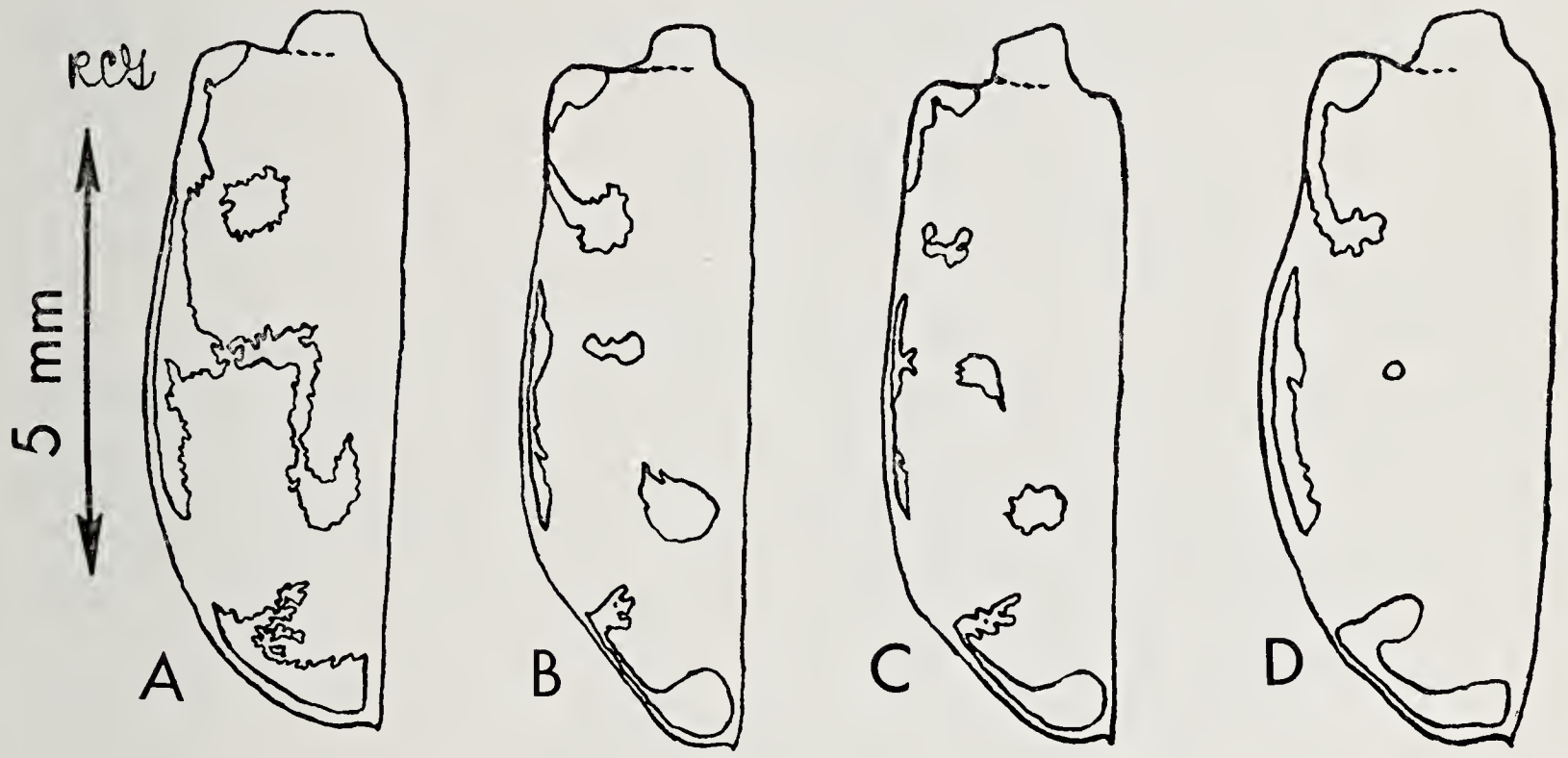

FIGURE 1. Left elytra of *Cicindela repanda* from Grand Sable Dunes, Alger County, Michigan: A. male with nearly normal *C. repanda* pattern but showing "erosion" of white markings; B. and C. two males showing markings reduced to widely separated spots; D. female with complete absence of the middle band.

The whole problem of intra-specific variation in *Cicindela* is exceedingly complex. It cannot be adequately explained simply as a consequence of climatic conditions (Shelford, 1917) as the various Lake Superior and Maritime populations are subject to similar environments, and yet show pronounced differences in macular variation within relatively short distances (*i. e.,* along the shore of Lake Superior). In some species, this might be explained as due to isolation as "demes". This may be true to some extent in *C. repanda* yet it is one of the most widespread and ubiquitous of North American *Cicindela* species and as such there should be sufficient "gene flow" to prevent population variations of this sort. The answer depends upon further study of *C. repanda* populations throughout the entire distribution of this species.

It is interesting to note that in the closely related species, *C. hirticollis,* elytral maculae are also greatly reduced in the northern Great Lakes area. *C. hirticollis* is presently under study by the author throughout its distribution. Similar study is needed on *C. repanda.* It is obvious that the same genes are operating in *C. repanda, C. hirticollis* and *C. duodecimguttata* with regard to macular variations but intra-specific variation in these three species provides problems, the answers for which depend upon more complete study of large series from many localities.

LITERATURE CITED

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REVIEWS

WORLD CROP PRODUCTION. Volume I: *PESTS AND DISEASES*. By J. H. SHAPLEY and F. C. H. GAYNOR. Cleveland: Chemical Rubber Company Press, 1969, 270 pp. Cloth $18.50.

This book provides the first single volume survey of the principle pests and diseases of the main cultivated crops in the world today. Wheat, barley, oats, rice, corn, sorghum, potatoes, sugar beets, cotton, sugar cane, tobacco, apples, pears, peaches, citrus fruits, grapes, olives, coffee, cocoa, tea, bananas, rubber, coconuts, and palm oil are considered individually. An introductory statement of importance, followed by descriptions (not diagnostic) of pests and diseases, their life history, distribution, damaged caused, selected methods of control, and a few illustrations form the bulk of the book. References are given at the end of each crop described. The final chapter deals with herbicidal weed control.

The plan is good, but, because of its wide scope, its weakness is its brevity. The description of pests and diseases requires for identification constant reference to other books and articles, only a few of which are listed. The methods of control considered are those most widely used on a world-wide basis, not necessarily the most up-to-date. Likewise, this means constant reference to other works since the most recent references given were published in 1965.

Thirty-three genera (including 7 'genus spp.' groups and 2 genus only) and 34 species of Coleoptera are mentioned. Of these, 14 species, 4 'genus spp.' groups, and 1 group (white grubs), are discussed in some detail including the mention of controls.

This readable account will be of general interest to the economic entomologist and plant pathologist, but not particularly to the coleopterist.—ERIC H. SMITH, Purdue University.

WORLD CROP PRODUCTION. Volume II: By K. A. HASSALL *PESTICIDES*. CRC. Press, 1969, 249 pp. Cloth $16.60.

This book provides basic information about pesticides and, by considering in detail a few of the more important chemicals in use, illustrates the fundamental principles underlying crop protection. Discussions include methods of application, routes by which the toxicant reaches the site of action, the barriers it encounters, and the functions of supplementary chemicals. The nature of toxic hazzards is explained and methods for minimizing toxic effects are discussed. Biochemical mechanisms are included and the various aspects of selective action are considered. The organochlorine and organophosphorus insecticides are comprehensively covered, and the properties of spray supplements and of organic and inorganic fungicides are discussed in detail. Natural insecticides, synthetic carbamate insecticides, organic acaricides, and herbicides are discussed in less detail.

The author does a commendable job in accomplishing his purpose. A very readable account of much detailed information on the nature of toxicants and how toxicants get their job done is presented.

Students, teachers, and the educated layman alike will find this a valuable guide with the proper perspective on the confusing and conflicting information published on this subject.—ERIC H. SMITH, Purdue University.